

The opinion in support of the decision being entered today was **not** written for publication in a law journal and is **not** binding precedent of the Board.

Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KENICHI NANBU
and TAMOTSU MORIMOTO

Appeal No. 2002-0690
Application 09/233,073¹

ON BRIEF

MAILED

AUG 14 2003

**PAT. & T.M. OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES**

Before PAK, LIBERMAN, and DELMENDO, Administrative Patent Judges.

PAK, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. §134 from the examiner's refusal to allow claims 1 through 14. These are all the claims pending in this application.

¹ Application for patent filed January 19, 1999.

APPEALED SUBJECT MATTER

Claims 1, 2, 3 and 7 are representative of the subject matter presently on appeal and read as follows:

1. An etching method comprising:

an etching gas supply step of supplying an etching gas through a gas supply system into a plasma producing chamber;

a plasma producing step of producing radicals in the plasma producing chamber by converting the etching gas into a plasma by applying radio frequency power to the etching gas;

and

an etching step of etching an object to be processed in a reaction chamber, which is connected to the plasma producing chamber and is evacuated, by the radicals flowing from the plasma producing chamber into the reaction chamber;

wherein the etching gas is supplied through the gas supply system at an etching gas supply rate of 8.4 sccm or above for a substantial volume of one liter of the reaction chamber.
2. The etching method according to claim 1, wherein the plasma producing step converts the etching gas into a plasma by inductive coupling using an induction coil.
3. The etching method according to claim1, wherein the etching step uses chlorine gas as the etching gas and etches a polysilicon film formed on the object to be processed.
7. The etching method according to claim 1, wherein a flow of etchant is provided at

a flow rate which produces a flow diverging position with respect to an outer periphery of an object being etched that is substantially at or internal to the outer periphery of the object being etched.

PRIOR ART

The examiner relies on the following prior art references:

Collins et al. (Collins)	5,556,501	Sep. 17, 1996
Szwejkowski et al. (Szwejkowski)	5,338,398	Aug. 16, 1994
van Os et al. (van Os)	5,792,272	Aug. 11, 1998

REJECTIONS

The claims on appeal stand rejected as follows:

- 1) Claims 1-6 and 11-13 under 35 U.S.C. §103 as unpatentable over the combined teachings of Collins and Szwejkowski; and
- 2) Claims 7-10 and 14 under 35 U.S.C. §103 as unpatentable over the combined teachings of Collins, Szwejkowski and van Os.

OPINION

We have carefully reviewed the claims, specification and prior art, including the arguments presented by the examiner and the appellants in support of their respective positions. This review has led us to conclude that the examiner's § 103 rejections are not well founded. Accordingly, we reverse these rejections. However, we enter new grounds of rejection pursuant to the provisions of 37 C.F.R. §1.196(b) (2000). Our reasoning for this determination follows.

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As urged by the appellants in their Brief and Reply Brief, there is no motivation or suggestion present to combine the prior art references relied upon by the examiner. Specifically, on this record, the examiner has not supplied any evidence to conclude that the reaction conditions useful for the RIE (reactive ion etching) process of Szwejkowski are also useful for the ICP (inductive coupled plasma) process of Collins. Accordingly, we reverse the aforementioned Section 103 rejections.

NEW GROUNDS OF REJECTION:

Pursuant to the provisions of 37 C.F.R. § 1.196(b), we enter the following new grounds of rejection.

Claims 1, 3-4, 6-7 and 9-10 are rejected under 35 U.S.C. § 102(b) as being anticipated by the disclosure of Szwejkowski.

We start with the claimed language. See In re Paulsen, 30 F.3d 1475, 1479, 31 U.S.P.Q.2d 1671, 1673 (Fed. Cir. 1994). We give the words in the claims on appeal the broadest reasonable interpretation consistent with the specification. In re Hyatt, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). See also In re Morris, 127 F.3d 1048, 1054-55, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997) ("PTO applies to verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in applicant's specification.").

The claimed subject matter is directed to an etching method in which an etching step is performed in a reaction chamber that is connected to a plasma chamber. See, e.g., claim 1. The reaction chamber is evacuated before the plasma formed in the plasma chamber is introduced therein. Id. The plasma is formed by applying a radio frequency power to an etching gas. Id. The plasma and reactor chambers can be located in the same reactor. See, e.g., Figure 1, areas 20 and 22, together with, e.g., claim 1. The etching method as claimed is not limited to an ICP process. See, e.g., claim 1.

We find that Szwejkowski discloses a RIE process that uses chlorine gas as an etchant at a flow rate of approximately 13.3 sccm per liter. See column 4, lines 15-25. This flow rate, according to the appellants, is useful for producing "a flow diverging position with respect to an outer periphery of an object being etched that is substantially at or internal to the outer periphery of the object being etched". See, e.g., claims 1 and 7. We find that Szwejkowski also discloses converting chlorine gas into a plasma that can be used to etch polysilicon. See column 4, lines 22-25 and 38-40. We find that Szwejkowski further discloses that its RIE process is performed in a vacuum apparatus such as the one disclosed in Cheng (Cheng is incorporated by reference at column 2, line 40, of Szwejkowski). See Ultradent Prods., Inc. v. Life-Like Cosmetics, Inc., 127 F.3d 1065, 1069, 44 USPQ2d 1336, 1339-40 (Fed.Cir.1997) (holding that material incorporated by reference into a document may be considered in an anticipation determination).

We find that Cheng discloses a magnetic field enhanced plasma etch reactor (vacuum apparatus) used for RIE processes, such as those described in Szwejkowski. See column 1, lines 10-16. The reactor has a plasma producing chamber (area 110) and a reaction chamber (the area

where a wafer 75 is located, together with an evacuation system 106, a gas inlet system 81 and a clamping ring 78). See Figure 7, together with column 8, lines 3-12. The plasma producing chamber is supplied with RF energy to convert an etchant into a plasma useful for etching the wafer. See column 5, lines 53-56 and column. 8, lines 5-11.

Thus, we find that Szejewski, as explained by Cheng, fully describes the claimed subject matter within the meaning of 35 U.S.C. §102(b). In reaching this decision, we consider the showing in the specification and the drawings. However, we determine that such showing cannot overcome a rejection based on 35 U.S.C. §102. See In re Malagari, 499 F.2d 1297, 1302, 182 USPQ 549, 553 (CCPA 1974).

Claims 1-6 and 11-13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the disclosure of Collins.

Collins discloses an ICP etching process that uses chlorine gas to etch polysilicon. See column 3, lines 40-50 and column 22, lines 44-50. The plasma is initially formed by applying RF power to chlorine gas in a first chamber. See column 3, lines 45-48. The etching reaction occurs in the second chamber equipped with a vacuum system after the plasma is introduced. See column 7, lines 39-45. The pressures of the first and second chambers are maintained between 2 and 20 mTorr. See column 22, lines 44-50.

Collins does not specifically mention supplying the etching gas at a rate that falls within the claimed range, i.e., between 8.4 and 16.9 sccm. However, throughout the disclosure, Collins emphasizes the importance of the flow rate of the etching gas in the ICP etching process. Collins, for example, employs multiple gas injection sources, with one exemplified flow rate of

50 cc, to enhance the ICP etching process. See column 9, lines 64-67, column 10, lines 1-5 and column 22, lines 44-50. Collins also discloses the use of a controller to monitor the conditions during the ICP etching process, with such controller being also geared to regulate the gas flow rate. See column 18, lines 1-5. Thus, it can be inferred from Collins that the flow rate is a result effective variable. It follows that the optimization of a result effective variable (flow rate) in the ICP etching process of Collins is deemed to be well within the ambit of one skilled in the art. See In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936-37 (Fed. Cir. 1990) ("The law is replete with cases in which the difference between the claimed invention and the prior art is some range or variable within the claims....These cases have consistently held that in such a situation the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range."). See also, In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980) (holding that optimization is obvious when the variable to be optimized is recognized as a result effective variable).

The appellants argue that one with ordinary skill in the art would not be motivated to employ the claimed flow rate because ICP processes, such as those described in Collins, have traditionally used flow rates lower than that claimed due to their reliance on "production of a high density plasma cloud and diffusion spread of the radicals in [a] low pressure environment.." See the Brief, page 13. However, the appellants' argument is based on unsubstantiated assumptions. See In re De Blauwe, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984) (mere arguments in the Brief or conclusory statement in the specification cannot take the place of

objective evidence); accord In re Schulze, 346 F.2d 600, 602, 145 U.S.P.Q. 716, 718 (C.C.P.A.1965).

The appellants point to the specification and the drawings to show that the claimed subject matter imparts unexpected results. A close review of the specification and of the drawings, however, leads us to conclude that the appellants have not carried the burden of showing unexpected results. See In re Freeman, 474 F.2d 1318, 1324, 177 USPQ 139, 143 (CCPA 1973). Nor have the appellants shown that the showing provided therein is reasonably commensurate in scope with the claimed invention. See In re Kulling, 897 F.2d 1147, 1149, 14 U.S.P.Q.2d 1056, 1058 (Fed. Cir. 1990) (holding that the evidence must be reasonably commensurate in scope with the claimed invention).

The appellants assert that Figure 3 shows that the claimed flow rate unexpectedly results in a significant reduction of etch rate change, thereby obtaining more uniform etching. See the Brief, page 20. However, Figure 3 shows that the etch rate at the edge of a wafer changes by the same proportion no matter what flow rate is used. Figure 3, therefore, does not support the appellants' assertion that the claimed invention imparts unexpected results.

The appellants also assert that Figures 4a-c and Figures 6a-c show that the claimed flow rate reduces the etch rate change at the periphery of a wafer, i.e., obtention of more uniform etching. See the Brief, pages 20-25. The appellants, however, have provided no sufficient explanation why and how these figures support the appellants' assertion. See, e.g., In re Borkowski, 505 F.2d 713, 719, 184 USPQ 29, 33 (CCPA 1974). Thus, the appellants fail to

carry their burden of showing that the claimed invention imparts unexpected results. Freeman, supra.

The appellants further assert that Figures 7a-c and 8a-b show how the flow diverging position changes as the flow rate of the gas is increased. See the Brief, pages 20-25. In other words, the claimed flow rates unexpectedly provide the desired flow diverging positions. Id. Yet, Figure 7c appears to show to the contrary. It appears to show that the flow diverging position at the known flow rate of 250 sccm to be right on the edge of a wafer, like the flow diverging position at a flow rate of 500 sccm (claimed subject matter). It follows that the appellants have not demonstrated that Figures 7a-c and 8a-b show that the claimed invention imparts unexpected results.

To the extent that the specification examples and the drawings impart unexpected results, we determine that the showing therein is not commensurate in scope with the claims on appeal. While the showing is limited to employing couple flow rates at specific ICP reaction conditions, the claims on appeal are not so limited. Claim 1, for example, does not even recite specific ICP reaction parameters, much less an ICP process.

Thus, on this record, we determine that the evidence of obviousness, on balance, outweighs the evidence of non-obviousness proffered by the appellants. Hence, we conclude that the claimed subject matter as a whole would have been obvious to one of ordinary skill in the art in view of Collins.

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TIME PERIOD FOR RESPONSE

This decision contains a new ground of rejection pursuant to 37 CFR

§1.196(b)(amended effective Dec. 1, 1997, by final rule notice, 62 Fed. Reg. 53,131, 53,197

(Oct. 10, 1997), 1203 Off. Gaz. Pat. & Trademark Office 63, 122 (Oct. 21, 1997)). 37 CFR

§1.196(b) provides that, "A new ground of rejection shall not be considered final for purposes of judicial review."

37 CFR §1.196(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of proceedings (§1.197(c)) as to the rejected claims:

- (10) Submit an appropriate amendment of the claims so rejected or a showing of facts relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the application will be remanded to the examiner
- (11) Request that the application be reheard under §1.197(b) by the Board of Patent Appeals and Interferences upon the same record. . . .

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REVERSED/37 CFR §1.196(b)


CHUNG K. PAK

Administrative Patent Judge


PAUL LIEBERMAN

Administrative Patent Judge


ROMULO H. DELMENDO

Administrative Patent Judge

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